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March 28, 2003   **RECEIVED**

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Oral Ex Parte Presentation: IB Docket No. 01-185

Dear Ms. Dortch:

This letter pi-ovides notice that on March 26, 2003, Mr. Charles Trimble, Chairman of the U.S. GPS Industry Council ("Council"), Ms. Ann Cigancr, Council's Director of Policy, Ms. Amy Mehlinan of Capitol Coalitions and undersigned counsel, met with the Eight Floor Legal Assistants copied below in separate meetings to discuss aspects of the Report and Order adopted on January 29, 2003 in the referenced proceeding. The same parties in a scparatc meeiing also met with Mr. Ed Thomas, Chief of the Office of Engineering and Tcchnology and OET staff members copied below. Council representatives expressed concern with the out of band emission ("OOBE") limits adopted for MSS ATC in the 1525 – 1559 MHz band and with the suggestion of a public notice on levels of protection for GPS.

On July 17, 2002, the Council and MSV (the MSS operator in this scgment of the band) suhmitted to the record of this procccding an agreement that MSS ATC OOBE limits in this band should be set at –90/-95/-100 dBw/MHz (copy attached). On January 24. 2003, NTIA filed a letter with the Cominission (copy attached) endorsing the industry agrccment on OOBE in this band. The Report and Order, however, established a different OOBE in this band, which the Council bclieves is inappropriate to protect passivc GPS receivers that provide safety-of-life and other critical services. The Council tirged that the Commission should adopt the OOBE limits set out in the industry agreement and as endorsed by NTIA.

Council representatives also expressed concern with the Commission's issuing a public notice to consider protection levels for GPS. The United States provided ITU-R Study Group 8D a list of GPS services (copy attached) that details the many services and applications made possible through use of GPS and their importance to safety-of-life and

many other vital services. These services are even more critical today to public safety, our national security and to all sectors of our economy. Council representatives also provided copies of the attached two recent articles describing the importance of GPS to our national defense. There is no need for a public notice on a matter where so much information is already available in the public domain, and certainly not at this point in time.

An original and one copy of this letter are being submitted for inclusion in the record of this procceding.

Respectfully submitted,

Raul R. Rodriguez
Counsel to the U. S. CPS Industry Council

RRR:jmr
Attachment

cc: (by email w/o attachments):

Bryan Tramont
Sam Feder
Jennifer Manner
Barry Ohlson
Paul Margie

OET:

Ed Thomas
Alan Scrime
Michael Marcus
Karen Rachley
John Reed

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July 17, 2002

<u>Via Hand **Delivery**</u>

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. **20554**

> **Re:** **Ex Parte** Notice
> IB Docket **No. 01-185**
> **File No. SAT-ASG-20010302-00017 et al.**

Dear Ms Dortch.

    We are pleased to inform you that the U.S. GPS Industry Council ("Council") and Mobile Satellite Ventures L P ("MSV") have agreed on specific out-of-band emission ("OOBE) limits into the entire GPS band for the ancillary terrestrial component **("ATC")** base stations and terminals that MSV will deploy in connection with its proposed next-generation Mobile Satellite Service system as described in the attached document. These OOBE limits are intended to protect GPS receivers

    These limits are -100 dBW/MHz for ATC base stations and initially -90 dBW/MHz for terminals operating in an ATC mode. For new terminals, the limit will be tightened to -95 dBW/MHz within five years from the date MSV service commences. This increase in protection is to account for a greater density of users and the need to protect GPS receivers from the aggregation of interference from multiple sources. MSV currently plans that all MSV terminals will include GPS chipsets and process GPS signals.

    These OOBE limits are appropriate considering that MSS services, technical characteristics, operational interference scenarios, and expected density are published and understood. MSV's proposed terrestrial augmentations are also well known. Consequently, these OOBE limits developed for the MSV service are unlike the OOBE limits required to address emerging novel communication techniques with 1) poorly documented technical and operational characteristics; **2)** ubiquitous deployment in a broad **range** of **electronic devices; and** 3) deployment in large-scale, overlapping networks
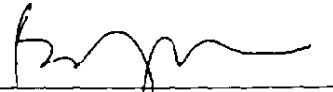
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MSV and the Council therefore urge the Commission to adopt in the referenced proceedings the OOBE limits set out in the attached document and as described **above.**

Please direct any questions regarding this matter to the undersigned.
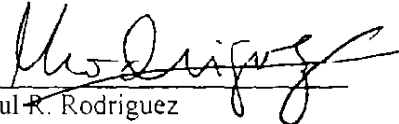
Respectfully submitted.

MOBILE SATELLITE VESTURES L.P.

By: _____
Bruce D. Jacobs

Shaw Pittman L.L.P.
2300 N Street. N.W.
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Its Attorneys

THE U.S. GPS INDUSTRY COUNCIL

By: _____
Raul R. Rodriguez

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Its Attorneys

cc (w/ attach.; by hand):   Thomas Tycz
                            James Ball
                            Breck Blalock
                            Ron Repasi
                            Trey Hanbury
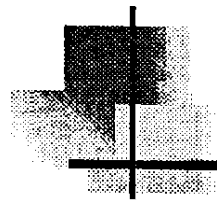
Agreement
on the Out-of-Band Emissions Limits

Mobile Satellite Ventures L.P.
The U.S. GPS Industry Council
17 July 2002

A More Restrictive Emission Limit in GPS Band Is Appropriate for ATC Operations

- Current MSS emission limit (-70 dBW/MHz) was derived to protect aviation GPS from satellite-based services
  - 100 feet separation, -10 dB GPS antenna gain towards emitter, resulting in 76.1 dB emission attenuation
- There is likely to be a greater density of users operating in the ATC mode than in the satellite mode
- Users operating in the ATC mode are more likely to be in close proximity to terrestrial GPS users
  - Indoor users include FCC mandated E-911 terminals
  - At 2 meters, attenuation is only 42.4 dB
    - -70 dBW/MHz results in interference that is 29 dB above the thermal noise floor
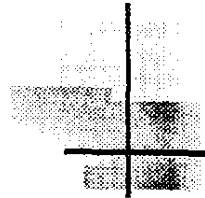
MSV Emission Limits

- For Base Stations
  - Use filtering to achieve -100 dBW/MHz, or lower
  - Achievable with larger envelope filters
- For Terminals
  - Use filtering to achieve -90 dBW/MHz, or lower, in short-term
  - Migrate to -95 dBW/MHz, or lower, for new terminals in 5 years (from the date MSV service is operational)
  - Either limit is still above thermal noise at 2 meters
- All limits are applicable from 1559 MHz to 1605 MHz to protect modern GPS receiver multipath mitigation technology

UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and
Information Administration
Washington, D C 20230

January 24, 2003

Mr. Edmond Thomas
Chief, Office of Engineering & Technology
Federal Communications Commission
445 12th Street, S W
Washington, DC 20554

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FEB 1 0 2003

Federal Communications Commission
Office of the Secretary

01-185

Dear Mr Thomas

In our November 12,2002 letter, we provided comments on the Federal Communication Commission's (FCC) *Notice of Proposed Rulemaking (NPRM)* in the *Mutter of Flexibility for Delivery of Communications by Mobile Satellite Service Providers* in the 2 *GHz, the L-Bund. and 1 6/2 4 GHz Bund.* In that letter, we recommended equivalent isotropically radiated power (ElRP) limits to protect Global Positioning System (CPS) receivers when used in both aviation and terrestrial scenarios.

In past proceedings, the National Telecommunications and Information Administration (NTIA) recommended EIRP limits of no higher than –40 dBm/MHz to protect GPS L1 reception in aviation scenarios for mobile satellite service (MSS) Mobile Earth Stations, 700 MHz conimercial base stations and mobile transmitters, and 700 MHz public safety base stations and inohilc transmitters. This emission limit was based on the only known safety of life application of GPS at the time, *i.e.,* for the aviation use of L1 case, and can also be applied to the MSS Ancillary Terrestrial Component (ATC) stations in the Big LEO, L-band and 2 GHz bands for aviation scenarios, If terrestrial scenarios involving safety of life applications of GPS in the L1 band, the L2 or any other frequency bands had been apparent during those rulemakings, NTIA would have used those scenarios in developing the emission limits.

At the 2000 World Radiocommunication Conference, a new allocation was adopted for the radio navigation satellite service (RNSS) in the 1164-1215 MHz frequency hand. As part of the GPS modernization program, a new GPS signal for aviation and non-aviation applications, designated as L5, will be provided in the 1164-1188 MHz portion of the newly allocated RNSS hand. In addition, a second signal similar in null-to-null bandwidth to the L1 coarse/acquisition (C/A) code signal will he provided in the GPS L2 frequency band of 1215-1240 MHz.[1] Therefore, in order to completely assess compatibility with the GPS operations, terrestrial receivers in the L1, L2, and L5 frequency hands should he analyzed. This was done for the first time during the FCC UWB rulemaking, which lead to the adoption of emission limits appropriate to the 2 meter separation distance in all three GPS bands.

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[1] The GPS Precision code (P-code) is currently transmitted in the 1215-1240 MHz band

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The NTIA recommended limits for MSS ATC components (base station transmitters (BTS), pico base stations, and mobile terminals (MT)) in our November 12, 2002 are shown in Attachment 1. The differences between the emission limits required for compatible operation with aviation and terrestrial CPS receivers can be attributed to the technical factors specific to each **use.** The aviation scenario considered an aircraft in the final phase of flight, during which the GPS receiver will be in the tracking mode of operation as opposed to the more sensitive acquisition mode of operation. The GPS signals seen by the aircraft receive antenna are essentially unobstructed. The interfering transmitter is located on the ground 30 meters directly beneath the aircraft and (because of aircraft shielding) an effective antenna gain of -10 dBi in the direction of the interfering transmitter was used in the analysis.

On the other hand, GPS receivers in the terrestrial scenario make use of signals which are barely above the receiver's tracking and acquisition thresholds, the antenna gain is typically 0 dBi, and distance separations between unconstrained interferers (*e.g.*, mobile hand-held devices, local area networks) nn the order of 2 meters can occur. The technical factors when considering interference to CPS receivers in the aviation and terrestrial scenarios are clearly very different, and emission limits based on aviation applications will not protect terrestrial applications of GPS from received interfering signal levels above the acceptable level at separation distance less than 30 meters from the MSS ATC stations. NTIA believes that our goal must be to protect those critical terrestrial applications of GPS and that the emission limits should be based on desired signal levels, distance separations and antenna couplings consistent with this use.

The most stringent EIRP limits on ATC shown in Attachment 1 are those based **on** a 2-meter separation between the MT and GPS receiver. Other separation distances and resulting EIRP limits on the MT are shown. If the protection distance were increased to *6* meters, the EIRP limits could he raised by 10 dB, or for the MT in the L1 band from -75 dBm/MHz to -65 dBm/MHz. If the protection distance were increased to 107 meters, the EIRP limit would be -40 dBm/MHz. In all of these scenarios, the MT is assumed to be in use by a person at the same time a second person within the protection distance was making a wireless, assisted E-911 under emergency conditions.

We have made some preliminary calculations shown in Attachment 2 to determine the effect that various EIKP limits would have on the ability of the GPS receivers to meet the FCC's E911 performance accuracy requirement of 150 meters with 95 % availability. Based on this analysis, it would appear that the -40 dBm/MHz would cause this performance availability to be significantly degraded. However, an EIRP of -65 dBm/MHz would stay within the FCC availability constraint. Moreover, at the -75 dBm/MHz level, the availability rate would be very high. Therefore. to maintain the desired performance availability, the EIRP limit for the MSS ATC mobile terminal should he -65 dBm/MHz.

On July 17, 2002 the GPS Industry Council and MSV jointly submitted an *ex parte* agreement to the **FCC** specifying that the MSV ATC base stations will "[u]se filtering *to* achieve -100 dBW/MHz [-70 dBm/MHz], or lower" emissions in the 1559-1605 MHz frequency band. Also, the *ex parte* filing states that the ATC Terminals will "[u]se filtering to achieve -90 dBW/MHz [-60 dBm/MHz], or lower, in [the] short-term" and will "migrate to -95 dBW/MHz [-65 dBm/MHz], or lower, for new terminals in 5 years (from the date MSV service is

operational)" for emissions in the 1559-1605 MHz band. Thus, it would appear that limits much more stringent than -40 dBm/MHz are attainable by the MSS ATC communities and agreeable with the GPS community.

NTLA believes that the protection of safety-of-life aviation and safety related terrestrial services is essential and suitable accommodation should be made. We **are** very reluctant and concerned to any relaxation of the emission level limits in the GPS bands that would seriously limit **the** many critical uses of terrestrial GPS services. We will work closely with the FCC to ensure that proper consideration is given to protection of the terrestrial GPS service.

Sincerely,

Fredrick R. Wentland
Acting Associate Administrator
    Office of Spectrum Management

2 Attachments

Sce o ario	GPS Band	MSS ATC Comp	GPS Rx Ht (m)	Tx Ht (m)	GPS to Tx Hor Dist (m)	Slant Rng (m)	GPS Rx Interf Susc Lvl (dBm/MHz)	Prop Loss (dB)	GPS Rx Ant Gain (dBi)	Interf Allot (dB)	Aviation safe mar-gin (dB)	Mult BTS Carr (dB)	Bldg Loss (dB)	Ant Gain Red (dB)	Avail Margi n (dB)	No. of Act ATC Eqis	Max EIRP (dBm/ MHz)
Terrestrial	L1	BTS	1.5	15	100	111	-117	76.5	0	-3		-4.8		.5		1	-47.8
	L2		1.5	15	100	111	-117	74.3	0	-3		-4.8		.5		1	-50
	L5		1.5	15	100	111	-117	73.9	0	-3		-4.8		.5		1	-50.4
	L1		1.5	30	150	153	-117	80.1	-3	-3		-4.8		3		1	-44.7
	L2		1.5	30	150	153	-117	77.9	-3	-3		-4.8		3		1	-16.9
	L5		1.5	30	150	153	-117	77.5	-3	-3		-4.8		3		1	-47.3
	L1	Pico	1.5	5	5	6	-117	52.1	-3	-3						1	-7u.9
	L2		1.5	5	5	6	-117	50	-3	-3						1	-73
	L5		1.5	5	5	6	-117	49.6	-3	-3						1	-73.4
	L1	MT			2		-117	42.4	0							1	.74.6
	L2				2		-117	40.3	0							1	-76.7
	L5				2		-117	39.8	0							1	-77.2
Aviation	L1	MT			30		-110.5	65.9	10	-3	-6					1	-43.6
Aviation	L5				30		-110.5	63.4	10	-3	-6					1	.46.1
Aviation.· AIC in rte	L1	Mult BTS	300	30		270	-116.5	-84.9	-10	6	6		-2.5	-30	38.9	863	-4u
Aviation.· A/C in rte	L5		300	30		270	-116.5	-82.5	-10	6	6		-2.5	-30	36.5	496	.4u
Aviation.· A/C in rte	L1		300	30		270	-116.5	-84.9	-10	6	6		-2.5	-30	43.6	2545	-44.7
Aviation - A/C in rte	L5		300	30		270	-116.5	-82.5	-10	6	6		-2.5	-30	43.8	2665	-47.3
Aviation - A/C in prec appr landing	L1	BTS	500 ft from run-way	30		150	-110.5	79.9	4.5	-6	-6	-4.8		2			-40.9
Aviation - appr landing	L5	BTS	500 ft from run-way	30		150	-110.5	77.4	4.5	-6	-6	-4.8		2			-41.4

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Maximum allowable EIRP of the Mobile Terminal = GPS Rx Interference Susceptibility Level + Propagation Loss (20 Log F t 2 0 Log D -27.55) + GPS Rx Antenna Gain

CPS Link	GPS Rx Interference Susceptibility Level (dBm/MHz)	Frequency (MHz)	Distance (meters)	GPS Rx Antenna Gain	Radiowave propagation Loss (dB)	Maximum Allowable EIRP (dBm/MHz)	Difference (dB)
_I	-117	1575.42	I2	I 0	42.4	-74.6	
	-1 17	1575.42	3	0	45.9	-71.1	3.5
	-I17	1575.42	4	0	48.4	-68.6	2.5
	-1 17	1575.42	5	0	50.4	-66.6	1.9
	-117	1575.42	I6	l 0	52.0	-65.0	1.6
	-117	1575.42	7	0	53.3	-63.7	1.3
	-I17	1575.42	8	0	54.5	-62.5	1.2
	-1 17	1575.42	9	0	155.5	-61.5	1.0
	-117	1575.42	10	0	56.4	-60.6	0.9
	-1 17	1575.42	15	0	59.9	-57.1	3.5
	- 117	1575.42	20	0	62.4	-54.6	2.5
	-117	1575.42	25	0	164.4	-52.6	1.9
	-117	1575.42	30	0	165.9	-51.1	1.6
	-1 17	1575.42	107	0	177.0	-40.0	11.0

Attachment **2**

Failure Rate Analysis

The failure rate of any system can be defined as follows:

Failure Rate = Number of Failures/Number of Trials

For communication systems the failure rate *is* expressed in terms of the bit error rate which is calculated as follows:

Bit Error Rate =Number of Bits in Error/Number of Bits Sent

The number of error bits *is* a function of the number of bits sent. **An** increase in bit error rate can be apportioned to different causes (e.g., momentary equipment failures, variations in propagation, or interference).

The aviation community describes failure rate in terms of Hull Loss during landings which is calculated as follows:

Hull **Loss** (landing) – Number of Aircraft Lost/ Number of Landings

Hull Loss can also be apportioned to different causes such as electronic failures or hydraulic failures. This can be further apportioned to individual components (e.g., hydraulic line failure).

The failure rate of GPS receivers used in urban environments can also be calculated in a similar manner. the case of GPS the failure rate is defined in terms of an increase in the receiver noise floor ($I/N = -6$ dB) for a CPS receiver operating at a minimum C/N_0 for at least one of the satellites required for a location solution. The number of failures for a CPS receiver operating in an urban environment can be calculated as follows:

Number of Failures = (N_{GPS}) $(P_{I/N=-6})$ $(P_{C/N})$

where :
　　N_{GPS} is the number of GPS uses;
　　$P_{I/N=-6}$ is the probability of causing an $I/N = -6$ dB;
　　$P_{C/N}$ is the probability of operating at a minimum C/N_0.

The failure rate is then calculated as follows:

Failure Rate =Number of Failures/ Number of GPS Uses = $(P_{I/N=-6})$ $(P_{C/N})$

If a ATC base station (BS) coverage defined by a 1 km radius is considered, the probability of causing an $I/N = -6$ dB can be computed as follows:

$$P_{I/N=-6} = (\pi (R_{GPS})^2 / \pi (R_{BS})^2 /3) N_{MT}$$

ere
　　R_{BS} is the radius of the **ATC** BS (m);
　　R_{GPS} is the protection radius for the GPS Receiver (m);
　　N_{MT} is the number of ATC mobile terminals operating in a 120 degree sector of **the** ATC base station

coverage area.

The protection radius of the CPS receiver is computed using the following equation:

$$R_{GPS} = 10^{(-It + EIRP + Gr - 20 \log t + 27.55)/20}$$

where:

It is the GPS receiver susceptibility level (dBm/MHz);
EIRP is the equivalent isotropically radiated power level of the transmitter (dBm/MHz);
Gr is the CPS receive antenna gain (dBi);
F is the GPS frequency (MHz)

Using the equation above the GPS protection radius for L1 receivers as a function of transmitter EIRP is shown in Table 1:

(dBm/MHz)	(dBm/MHz)	(dBi)		(m)
-117	-75	0	-36.4	1.9
-117	-65	0	-36.4	6.1
-117	-55	0	-36.4	19.2
-117	-45	0	-36.4	6C.6
-117	-40	0	-36.4	107.8

The Probability of Operating at a Minimum C/N_0 was determined from measurements performed by Qualcomm. A value of 5% (.05) is considered in this analysis.

Similar to the examples provided earlier, the overall CPS failure rare can be apportioned to different sources such as low desired signal levels, blockage from obstructions, and interference. The remainder of this analysis will consider the portion of the failure rate that results from interference.

Analysis Example

The CPS failure rate that can be attributed to interference must consider the potential multiple interfering sources that can occur in an urban operating environment such as: 1) ATC MTs of multiple service providers, 2) 700 MHz commercial and public safety mobile and portable transmitters, and 3) UWB handheld devices.

If an overall Failure rate for CPS receivers of 5% (95% availability) is considered and 40% of this can be attributed to interference then the failure rate for interference is 2% (0.02).[3]

700 MHz commercial and public safety mohile and portable transmitters arc permitted *to* operate at an EIRP of −40 dBm/MHz in the 1559-1605 MHz band used by GPS. As shown in Table 1 this EIRP equates to a CPS protection radius of 107.8 m. If it is assumed that there 10 of these devices operating within the ATC BS sector the GPS failure rate is[4]:

Qualcomm Written Ex Parte Presentation ET Docket No. 98-253 (Jan. 11, 2002) at pg. 13 Figure 3-6.
3 The Commission specifies E511 performance in terms of an accuracy of 150 m with 95% availability This indicates that 5% of the time this accuracy requirement will not he achieved.
4 The value of 10 devices underestimates the number of devices, there could be more devices operating bur it is assumed that the propagation loss in urban environments will reduce the distance to less rhan 107.8 m.

Failure Rate (700 MHz Equipment)= $10(0.0348)(0.05) = 0.0174$

UWB handheld UWB devices are permitted to operate at an EIRP of -75 dBm/MHz in the 1559-1610
MHz hand used by CPS. As shown in Table 1 this EIRP equates to a GPS protection radius 1.9 m. If it
assumed that there are 100 UWB devices operating in the ATC BS sector the GPS failure rate is:

Failure Rate (UWB Hand Held) = $100(1.925 \times 10^{-5})(0.05) = 5.5 \times 10^{-5}$

If ATC MTs operate at an EIRP limit of -65 dBm/MHz in the 1559-1605 MHz band a GPS protection
radius 6 m is necessary. Assuming hat there are three possible service providers (e.g., Rig LEO, 2 GHz, and L-
Rand) each with 21 MTs in the ATC BS sector, the GPS failure rate is:

Failure Rate (ATC MT) = $21 \times 3 \times (0.0001102)(0.05) = 3.5 \times 10^{-4}$

The total failure rate is calculated from the sum of the individual failure rates:

GPS Failure Rate = $0.0174 + 5.5 \times 10^{-5} + 3.5 \times 10^{-4} = 0.018$

The failure rate of 0.018 is slightly below the 0.02 allocated for interference. This leaves a small margin for
GPRs, through wall imaging systems. ATC BSs, and MSS handsets.

If however, the ATC MT is permitted to operate at an EIRP of -40 dBm/MHz the GPS protection radius
increases from 6 m to 107.8m and the GPS failure rate is:

Failure Rate (ATC MT) = $3 \times 21 \times (0.0348435)(0.05) = 0.1098$

This nuiiiher alone is larger than *the* 5% allowed for the total GPS failure rate.